Use of Small UAS for Earthquakes at NASA's Jet Propulsion Laboratory
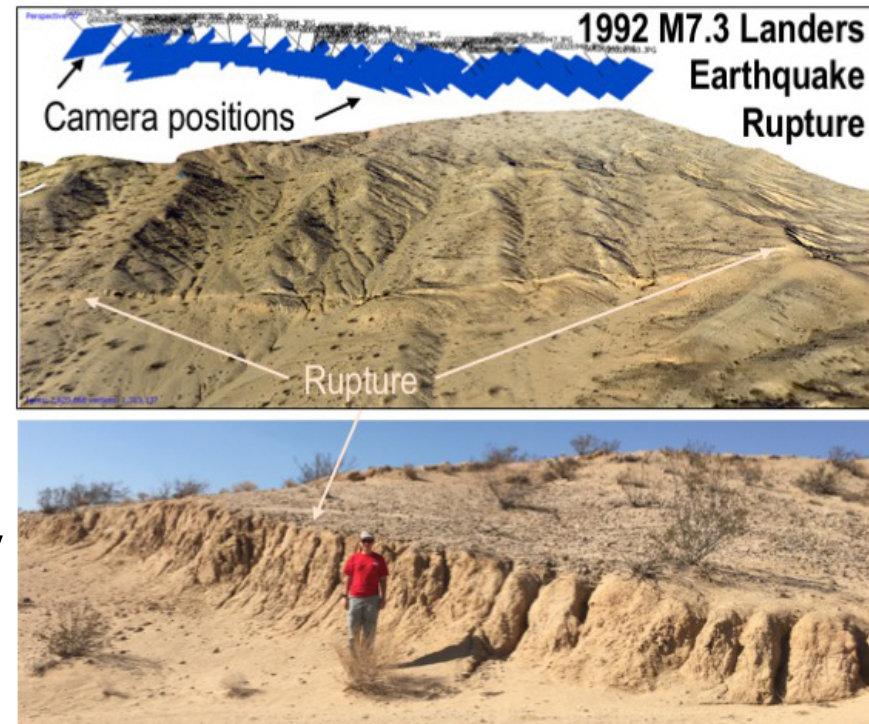
UAS Best Practices Panel at the 2017 Continuing Challenge

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NASA/JPL Research

- NASA is not an operational agency

- NASA Goals
  - Expand the frontiers of knowledge, capability, and opportunity in space
  - Advance understanding of Earth and develop technologies to improve the quality of life on our home planet
  - Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure

1992 M7.3 Landers Earthquake Rupture

Camera positions

Rupture

- NASA's Science Mission Directorate conducts scientific exploration that is enabled by access to space

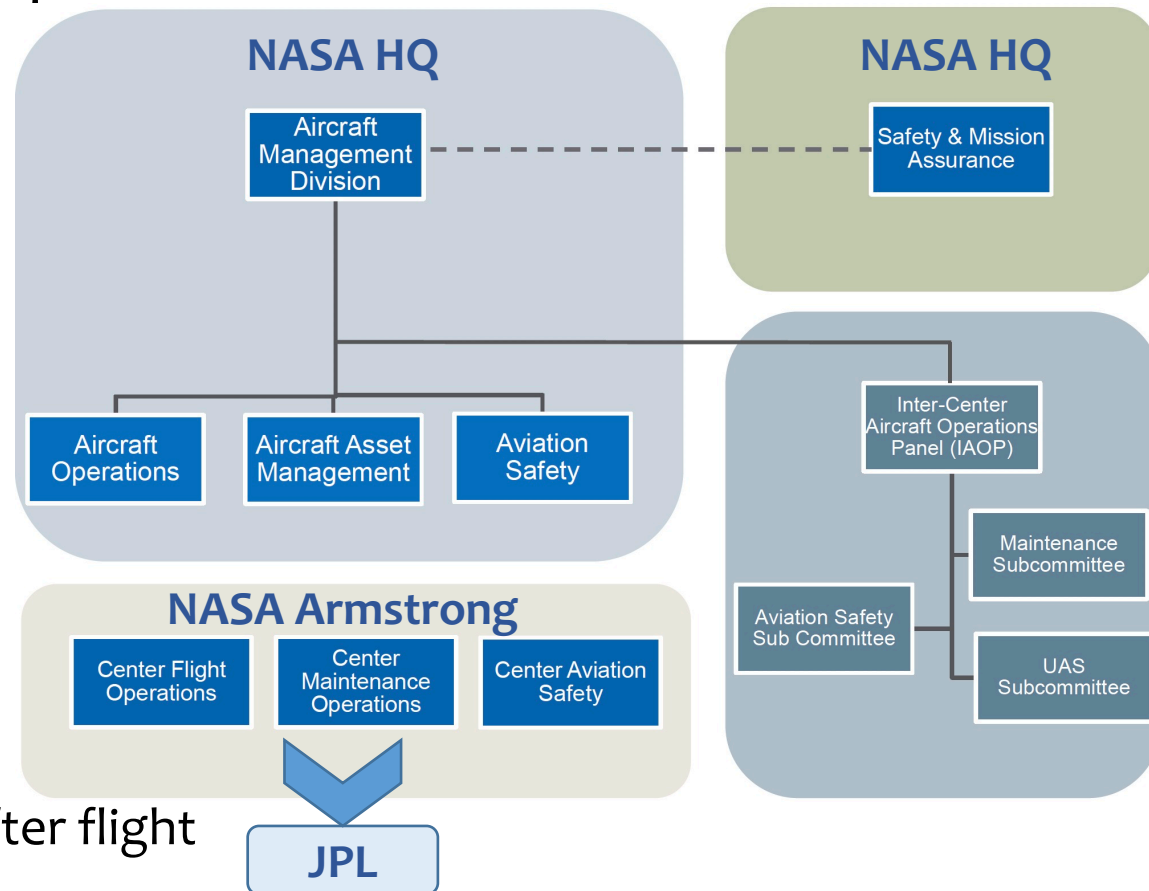- Emergency response and research goals may intersect

NASA/JPL's Use of Small UAS

- NASA-wide uses include inspection, emergency response, and research

- We focus on producing topographic products to research earthquake fault zones

- In the event of an earthquake research and emergency response needs can intersect
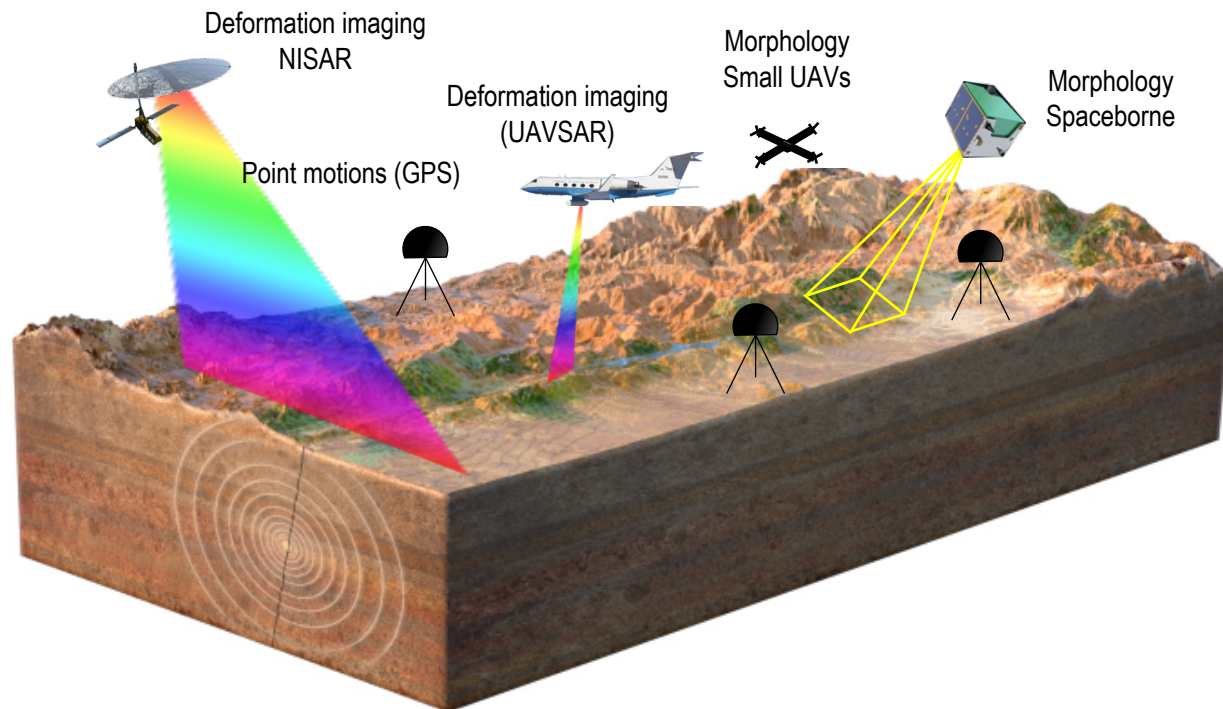
sUAS Program Organization

- Operations are by individual researchers at JPL
  - Standing up Near-Surface Airborne Instruments Lab (N-SAIL) to provide support

- Oversight is by a Flight Operations Center
  - NASA Armstrong Flight Research Center for JPL

- Requires
  - Pilot certification
  - Ground Control Operator certification
  - Flight test plan
  - Airworthiness certificate
  - Safety plan
  - COA
  - Notifications before and after flight

NASA HQ

Aircraft Management Division

NASA HQ

Safety & Mission Assurance

Aircraft Operations

Aircraft Asset Management

Aviation Safety

Inter-Center Aircraft Operations Panel (IAOP)

Maintenance Subcommittee

Aviation Safety Sub Committee

UAS Subcommittee

NASA Armstrong

Center Flight Operations

Center Maintenance Operations

Center Aviation Safety

JPL

Effective Types of sUAS Missions

- Demonstration data for new projects and missions

- Rapid response

- Configurable flight path

- Reasonably small area of interest (e.g. < 1 x 1 km)

sUAS Mission Management for Emergency Response

- Principal Investigator or team decides need

- NASA HQ approves data collection if it is beyond scope of existing project

- JPL needs to deconflict airspace with Cal-OES
  - Has not be tested or implemented yet

- Flights will require additional approvals from NASA Armstrong if outside existing approved areas

- JPL provides required flight notifications and collects data

- JPL processes data and produces higher level interpretable/actionable data products

- Products made available to Incident Commander/ Project Leader via Earthquake Clearinghouse and XchangeCore
  - http://www.eqclearinghouse.org/
  - http://www.xchangecore.org/

We are developing interfaces for sUAS observations

Transfer of Information

- JPL is active with the Earthquake Clearinghouse and XchangeCore

- JPL participates in earthquake response exercises with state and federal agencies